

Yang, et al.  
Atty. Dkt. No. 5333-02400

***In the Claims:***

Please cancel claims 1-6 without prejudice.

Please add the following claims.

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7. (new) A solid titanium catalyst for homo-polymerization and co-polymerization of ethylene, wherein the catalyst is produced by:

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preparing a magnesium compound solution by contacting a magnesium halide compound with an alcohol;

preparing a second solution by reacting the magnesium compound solution with an ester compound and a boron compound; and

reacting the second solution with a mixture of a titanium compound and a silicon compound to produce the solid titanium catalyst.

8. (new) The solid titanium catalyst of claim 7, wherein the produced solid titanium catalyst is further reacted with a second titanium compound.

9. (new) The solid titanium catalyst of claim 7, wherein the ester compound comprises an ester compound having at least one hydroxy group.

10. (new) The solid titanium catalyst of claim 7, wherein the ester compound comprises an unsaturated aliphatic ester having at least one hydroxy group.

11. (new) The solid titanium catalyst of claim 7, wherein the ester compound comprises 2-

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hydroxy ethylacrylate, 2-hydroxy ethylmethacrylate, 2-hydroxy propyl acrylate, 2-hydroxy propylmethacrylate, 4-hydroxy butylacrylate, or pentaerithritol triacrylate.

A\ 12. (new) The solid titanium catalyst of claim 7, wherein the ester compound comprises an aliphatic monoester having at least one hydroxy group or an aliphatic polyester having at least one hydroxy group.

13. (new) The solid titanium catalyst of claim 7, wherein the ester compound comprises 2-hydroxy ethyl acetate, methyl 3-hydroxy butylate, ethyl 3-hydroxy butylate, methyl 2-hydroxy isobutylate, ethyl 2-hydroxy isobutylate, methyl 3-hydroxy-2-methyl propionate, 2,2-dimethyl-3-hydroxy propionate, ethyl-6-hydroxy hexanoate, t-butyl-2-hydroxy isobutylate, diethyl-3-hydroxy glutarate, ethyllactate, isopropyl lactate, butyl-isobutyl lactate, isobutyl lactate, ethyl mandelate, dimethyl ethyl tartrate, ethyl tartrate, dibutyl tartrate, diethyl citrate, triethyl citrate, ethyl-2-hydroxy-caproate, or diethyl *bis*-(hydroxymethyl) malonate.

14. (new) The solid titanium catalyst of claim 7, wherein the ester compound comprises an aromatic ester having at least one hydroxy group.

15. (new) The solid titanium catalyst of claim 7, wherein the ester compound comprises 2-hydroxy ethyl benzoate, 2-hydroxy ethyl salicylate, methyl-4-(hydroxy methyl) benzoate, methyl-4-hydroxy benzoate, ethyl-3-hydroxy benzoate, 4-methyl salicylate, ethyl salicylate, phenyl salicylate, propy-4-hydroxy benzoate, phenyl-3-hydroxy naphthanoate, monoethylene glycol monobenzoate, diethylene glycol benzoate, or triethylene glycol monobenzoate.

16. (new) The solid titanium catalyst of claim 7, wherein the ester compound comprises an alicyclic ester having at least one hydroxy group.

17. (new) The solid titanium catalyst of claim 7, wherein the boron compound comprises a

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boron compound having an alkoxy group.

18. (new) The solid titanium catalyst of claim 7, wherein the boron compound comprises the general formula  $BR^1_n(OR^2)_{3-n}$ , wherein  $R^1$  comprises a hydrocarbon having between 1 to 20 carbons or a halogen element, wherein  $R^2$  comprises a hydrocarbon having between 1 to 20 carbons, and wherein n comprises an integer between 0 and 2.

19. (new) The solid titanium catalyst of claim 7, wherein the boron compound comprises trimethyl borate, triethyl borate, tributyl borate, triphenyl borate, methylboron diethoxide, ethylboron diethoxide, ethylboron dibutoxide, butylboron dibutoxide, phenylboron diphenoxide, diethylboron ethoxide, dibutylboron ethoxide, diphenylboron phenoxide, dioethoxyboron chloride, diethoxyboron bromide, diphenoxyboron chloride, ethoxyboron dichloride, ethoxyboron dibromide, butoxyboron dichloride, phenoxyboron dichloride, or ethylethoxyboron chloride.

20. (new) The solid titanium catalyst of claim 7, wherein the titanium compound comprises the general formula  $Ti(OR)_aX_{4-a}$ , wherein R comprises an alkyl group with 1 to 20 carbon atoms, wherein X comprises a halogen atom, and wherein a comprises an integer between 0 and 4.

21. (new) The solid titanium catalyst of claim 7, wherein the titanium compound comprises a titanium tetrahalide, wherein the titanium tetrahalide comprises  $TiCl_4$ ,  $TiBr_4$ , or  $TiI_4$ .

22. (new) The solid titanium catalyst of claim 7, wherein the titanium compound comprises an alkoxy-titanium trihalide, wherein the alkoxy-titanium trihalide comprises  $Ti(OCH_3)Cl_3$ ,  $Ti(OC_2H_5)Cl_3$ ,  $Ti(OC_2H_5)Br_3$ , or  $Ti(O(i-C_4H_9))Br_3$ .

23. (new) The solid titanium catalyst of claim 7, wherein the titanium compound comprises an alkoxy-titanium dihalide, wherein the alkoxy-titanium dihalide comprises  $Ti(OCH_3)_2Cl_2$ ,  $Ti(OC_2H_5)_2Cl_2$ ,  $Ti(OC_2H_5)_2Br_2$ , or  $Ti(O(i-C_4H_9))_2Cl_2$ .

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24. (new) The solid titanium catalyst of claim 7, wherein the titanium compound comprises a tetraalkoxy-titanium compound, wherein the tetraalkoxy-titanium compound comprises  $Ti(OCH_3)_4$ ,  $Ti(OC_2H_5)_4$ , or  $Ti(OC_4H_9)_4$ .

25. (new) The solid titanium catalyst of claim 7, wherein the silicon compound comprises the general formula  $R_nSiCl_{4-n}$ , wherein R comprises hydrogen, or R comprises an alkyl group, an alkoxy group, a haloalkyl group, or an aryl group having 1 to 10 carbon atoms, or R comprises a halosilyl group or a halosilyl alkyl group having 1 to 8 carbon atoms, and wherein n comprises an integer between 0 and 4.

26. (new) The solid titanium catalyst of claim 7, wherein the silicon compound comprises silicon tetrachloride.

27. (new) The solid titanium catalyst of claim 7, wherein the silicon compound comprises a trichlorosilane, wherein the trichlorosilane comprises methyltrichlorosilane, ethyltrichlorosilane, or phenyl-trichlorosilane.

28. (new) The solid titanium catalyst of claim 7, wherein the silicon compound comprises a dichlorosilane, wherein the dichlorosilane comprises dimethyldichlorosilane, diethyldichlorosilane, diphenyldichlorosilane, or methylphenyldichlorosilane.

29. (new) The solid titanium catalyst of claim 7, wherein the silicon compound comprises trimethylchlorosilane.

30. (new) The solid titanium catalyst of claim 7, wherein the ester compound comprises 2-hydroxyethyl methacrylate, wherein the boron compound comprises trimethyl borate, wherein the titanium compound comprises titanium tetrachloride, and wherein the silicon compound

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comprises silicon tetrachloride.

31. (new) The solid titanium catalyst of claim 7, wherein an amount of the mixture of the titanium compound and the silicon compound is between about 0.1 mol per mole of the magnesium halide compound and about 200 mol per mole of the magnesium halide compound, and wherein the molar ratio of the titanium compound to the silicon compound in the mixture is between about 0.05 and about 0.95.

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32. (new) A method for producing a solid titanium catalyst, comprising:

preparing a magnesium compound solution by contacting a magnesium halide compound with an alcohol;

preparing a second solution by reacting the magnesium compound solution with an ester compound and a boron compound; and

reacting the second solution with a mixture of a titanium compound and a silicon compound to produce the solid titanium catalyst.

33. (new) A solid titanium catalyst for homo-polymerization and co-polymerization of ethylene, wherein the catalyst is produced by:

preparing a magnesium compound solution by contacting a magnesium halide compound with an alcohol;

preparing a second solution by reacting the magnesium compound solution with an ester compound having at least one hydroxy group and a boron compound having an alkoxy group; and